Educating Youth in Water Quality Land Use Principles Through Outdoor Education[1]

KAREN MANCL AND GREGORY LABARGE, Department of Agricultural Engineering, The Ohio State University, Columbus, OH 43210 and Fulton County Extension, 135 Court House Plaza, Wauseon, OH 43567

ABSTRACT. **An annual five-day Conservation Camp is attended by 176 14- to 18- year old 4-H members. The campers receive field instruction in soils, water, forestry, wildlife and recreation related to land use and develop a land use plan. In 1993, the water quality portion of the program was evaluated to determine the effect on knowledge and skills. Pre/post tests, land use plans, and oral presentations were examined. Camper knowledge of water quality principles was significantly increased when compared to a control group. Most campers included erosion control practices in land use plans and all positioned water supplies upslope of pollution sources. About 40% of the campers included waste treatment systems in land use plans.**

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INTRODUCTION

The importance of providing future community leaders with the knowledge and skills necessary to make careful land use decisions has been pointed out by several investigators (Council on Environmental Quality 1981, Westphal and Halverson 1985, Jordon et al. 1986, Swader and Sweeten 1986). Outdoor educational settings have the potential to teach young people to consider environmental impacts when developing a home site, farm, business site, or entire community. Multiple day, residential programs appear to be a good setting to motivate youth to take actions in areas of which they are already aware (Jordan et al. 1986). Jordon et al. (1986) showed through a six-day residential workshop that instruction on issues awareness alone failed to increase participation in environmental behaviors. Instruction in both issue awareness and action strategies did increase participation in environmental behaviors. Shepard and Speelman (1985) demonstrated a relationship between the program length and the development of conservation attitudes in three- to five-day camps. They found a need for an acclimation period for urban campers and found that the greatest development of positive conservation attitudes was with first-time campers.

The Cooperative Extension system has a well established youth educational program known as 4-H. The 4-H programs in Ohio and many other states manage resident camps for outdoor education experiences. Since 1936 Ohio State University Extension has sponsored a 4-H Conservation Camp. Conservation education in a 4-H camp setting is one way to introduce youth to the field of natural resources (Stockdale 1962). 4-H programs also provide an opportunity to introduce young people to water quality and land use principles. A report on groundwater education by the Extension Committee on Organization and Policy pointed out the opportunities in the 4-H program. The report recognized that when developing water quality programs for young people, specific concerns may differ with time and location, but the basic principles of hydrology do not change (Swader and Sweeten 1986).

The goal of the instructional program reported here was to provide young people with basic water quality principles and to encourage them to incorporate these principles into land-use decisions. The specific objectives were for young people to learn about the relationship of nutrients to water quality, a watershed system, and the need to provide water supply and wastewater treatment for facilities that house people and animals. Other objectives were for young people to be able to relate land uses to water quality impacts, identify appropriate land uses to protect water quality, and explain how land use decisions affect water quality. This study was to assess whether a camp program was successful in increasing the knowledge and abilities of young people in considering water quality impacts in land-use decisions.

METHODS

The annual five-day 4-H Conservation Camp is offered to 14- to 18-year old 4-H members from across Ohio at Camp Ohio near Utica. Two 4-H members are selected by a local 4-H committee from applications in each of Ohio's 88 counties to attend the camp. Upon arrival campers are put into groups of four. Each group is presented with a 40-acre plot of farm ground that lies adjacent to the camp. On the fourth day of camp, each group is expected to present a map and oral report outlining their comprehensive land use plan for the 40-acre plot. An example of a land use plan map is presented in Fig. 1.

To prepare the campers to work on their land use plan, they receive a soils map of the land, are escorted on a walk across the property, and participate in 13 hours of instruction in seven sessions. The instruction includes a 1.5 hour lecture on soil suitability for different land uses. The campers are instructed in color-coding soils maps by suitability. They also receive field instruction in groups of 35 from five university faculty in 1.5-hour field instruction sessions covering soils, water, forestry, wildlife, and recreation.

In 1993, all 129 campers (55% girls and 45% boys) completed a nine-question pretest at the start of camp.

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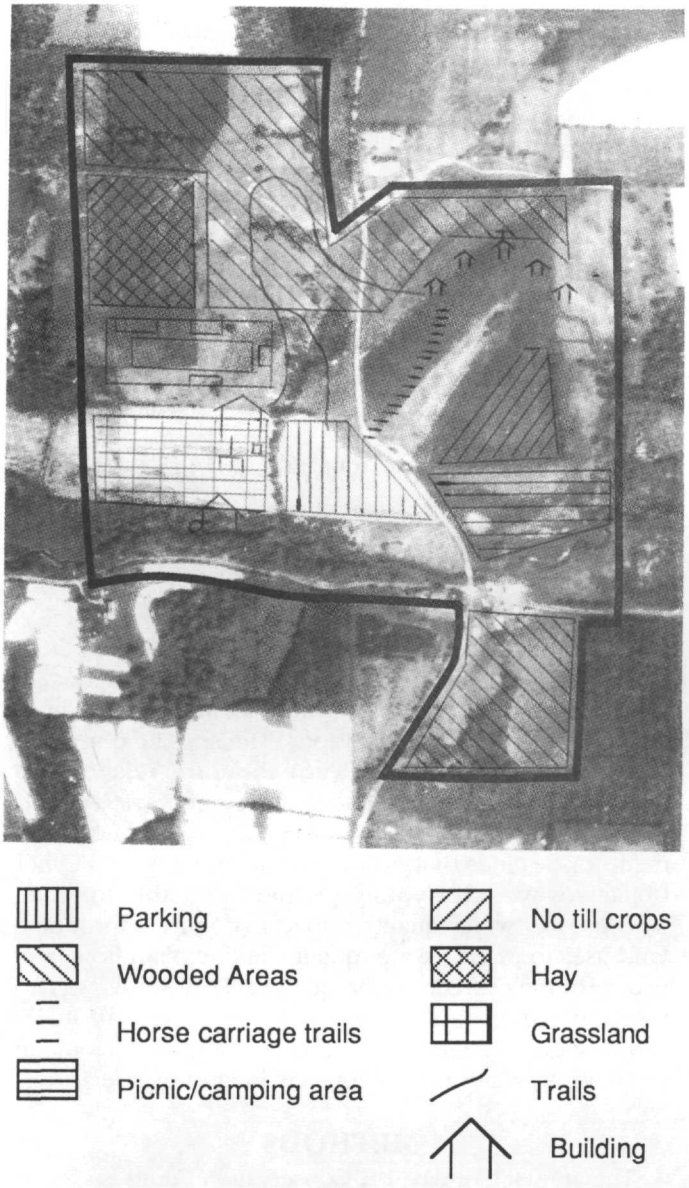

FIGURE 1. Example of camper land use plan.

The pretest addressed their knowledge of nutrient sources, safe water supply characteristics, wastewater treatment, and watersheds. The questions were multiple choice, true/false, or exercises. Along with the answer to the question, campers were asked to indicate if they were guessing or if they knew the correct answer. For a correct answer to be considered a correct response, the camper had to indicate that it was not a guess. This method of determining confidence in answers was successfully used by Alliger and Horowitz (1989) in training programs for adults. At the end of the camp, campers completed a similar posttest. The tests were coded so that the pretest and posttest from each camper could be paired.

The posttest was administered five days after the pretest. As with the pretest, a camper had to select the correct response and indicate that they were not guessing for an answer to be considered correct. The learning that took place between the pretest and posttest was indicated by an incorrect response on the pretest followed by a correct response to a similar question on the posttest.

The week following 4-H Conservation Camp, another group of 14- to 18-year olds attended 4-H Leadership Camp at the same facility. All of the 116 campers (72% girls and 28% boys) completed the same pretest and five days later the same posttest but received no instruction in land use planning or water quality. Simple *t*-tests for significance were conducted (SPSS 1993) to determine if the campers at Conservation Camp (treatment group) learned more than campers at Leadership Camp (control group). A total of 129 campers at 4-H Conservation Camp completed both the pretest and posttest and 116 campers at 4-H Leadership Camp completed both tests.

Each group of campers at 4-H Conservation Camp presented maps and an oral presentation of their land use plans on the fourth day of camp. A copy of each land use plan was collected and was examined to identify that the following tasks were accomplished: (a) Erosion control was planned to keep soil and nutrients from entering the stream on the property. (b) Each structure planned for people or animals had a water supply and waste treatment or handling system. (c) Septic systems were always indicated in soils suitable for a soil absorption field. (d) Water supply wells were positioned upslope and separated from pollution sources.

Each group made a 15-minute oral presentation of its land use plan. We and three other instructors listened for the use of six key words related to water quality: nitrogen, phosphorus, upslope, downslope, water, and sewage. These words were selected to determine if campers would connect important water quality issues of nutrient management, landscape positioning, and drinking water and wastewater treatment infrastructure with land use planning.

RESULTS

The test results from both camps are presented in Fig. 2. The overall pretest scores for each camp were 19% correct for the treatment group and 18% correct for the control group. In examining the pretest results for each question, the treatment group did not exhibit greater previous knowledge of any topic than the control group. The greatest previous knowledge for both groups was shown in what a watershed is, in water quality concerns of phosphorus, and that upslope activities can affect downslope water quality.

The pretest sensitivity was illustrated by the control group (Fig. 2). Overall the control group selected 18% correct responses on the pretest and 22% correct responses on the posttest. Correct responses increased in all of the areas tested. However, in all but one area combining pretest and posttest scores was less than 50% for the campers in the control group. The only exception was that upslope activities affect downslope water quality at a combined 62%.

The overall response of the treatment group was significantly improved. The overall scores rose from 19% on the pretest to 66% on the posttest. This result was significantly higher than the control group ($P < 0.0002$). Greater understanding of water quality principles was gained by the treatment group over the control group

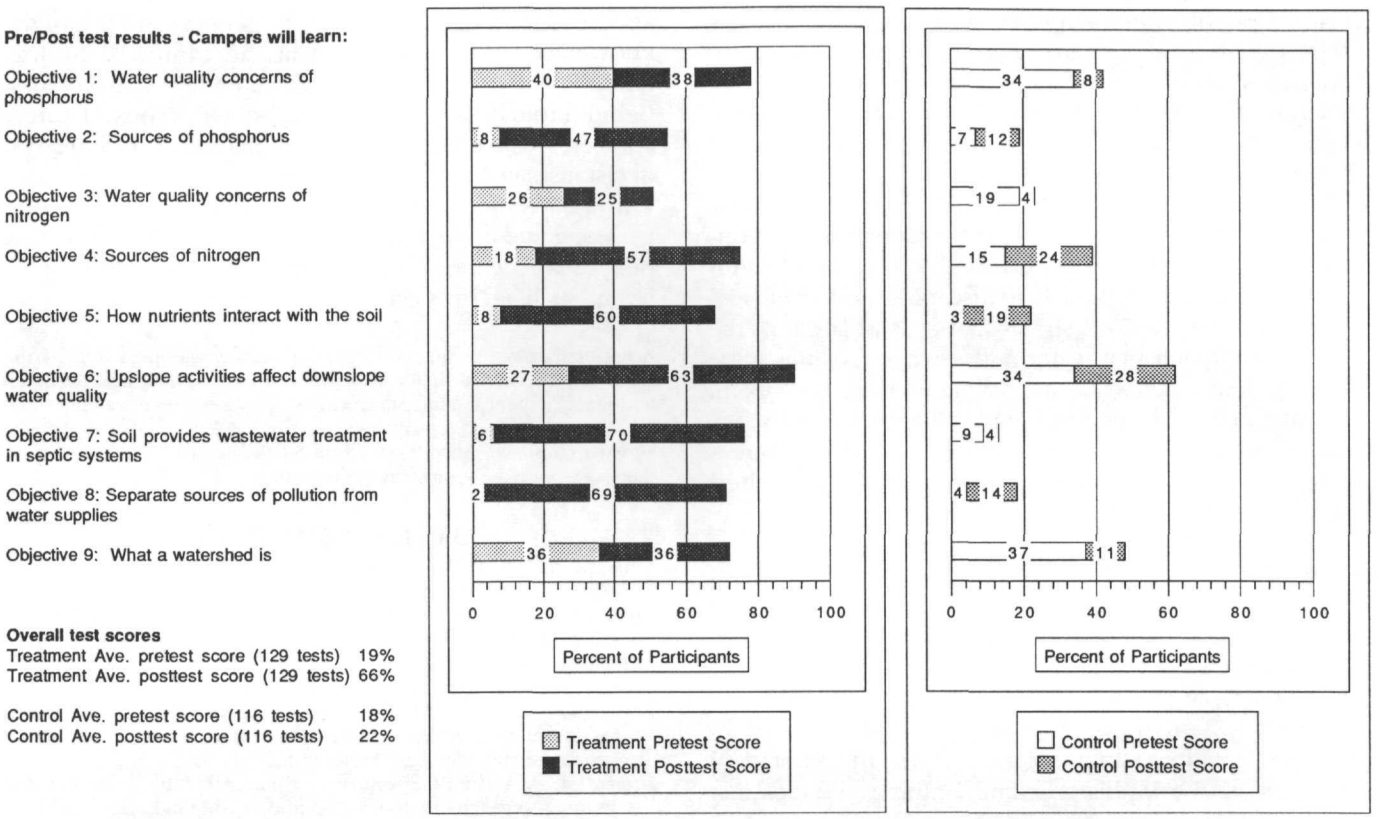

FIGURE 2. Pre/posttest results for 4-H Conservation Camp (Treatment) and 4-H Leadership Camp (Control).

in all areas. In all areas, combining previous knowledge to that learned at camp, more than 50% of the campers at 4-H Conservation Camp knew the basic water quality principles by the time they left camp. Over 50% of the campers learned at camp about sources of nitrogen, how nutrients interact with soil, that upslope activities affect downslope water quality, that soil provides the treatment in septic systems, and that it is important to separate sources of pollution from water supplies.

The next concern was whether the campers would incorporate this new knowledge of land use effects on water quality into their land use plans. Thirty-two land use plans were collected. Erosion control considerations were evident in 75% of the plans. Water supplies for structures to house people or animals were indicated in 38% and waste systems in 44%. Suitable soils for septic systems were selected in 35% of the plans. Water supplies were positioned upslope of pollution sources in 100% of the plans that indicated a water supply.

Water was mentioned during oral presentations by 63% percent of the groups and sewage was mentioned by 41%. Twenty-two percent of the groups included the words nitrogen and phosphorus in their presentations. The concept of upslope and downslope was described in 34% of the presentations.

DISCUSSION

Young people will soon be making decisions about how land will be used. Their involvement in these decisions may be as a home owner, farmer, business person, elected official, or a voter. An understanding of how land use decisions affect water quality can help any decision maker balance land use and environmental impact considerations.

The 4-H Conservation Camp offered by Ohio State University Extension has been shown to be an effective method of teaching young people water quality land use principles. When compared against a similar group of campers, the participants in 4-H Conservation Camp had a greater knowledge of nutrient sources, safe water supply considerations, wastewater treatment, and watersheds.

The effect of pretests on posttest results is always a concern (Ary et al. 1985). Participants may learn subject matter from the pretest. The issues and questions raised by the pretest may prompt students to consider and draw from previous experience so they are more prepared to respond in the posttest. They also become familiar with the testing format and may be less anxious when taking the posttest. Pretest sensitivity was illustrated as expected by the Leadership Camp control group. In every case their number of correct responses increased slightly from the pretest to the posttest. The Conservation Camp treatment group responses were significantly higher than the control group demonstrating the effectiveness of the educational program.

Many of the participants in 4-H Conservation Camp were also able to incorporate water quality principles into land use plans that they presented at the camp. Erosion control considerations (75%) and the relative

positioning of water supplies and pollution sources (100%) were used in a majority of the land use plans. Provisions for water systems and waste systems for structures for people and animals as well as siting septic systems in suitable soils were included in more than a third of the plans.

To a lesser extent than their prepared land use plans, youth expressed their attention to water quality concerns in oral presentations. Over 60% mentioned water in a presentation of their land use plan and over 40% mentioned sewage. This shows that at least some of the young people felt that water and sewage facilities were worth pointing out while briefly highlighting their plan. Considerations of nitrogen and phosphorus and the relative position of water supplies and pollution sources were cited less by young people in describing their land use plans.

More attention is needed to increase consideration of water and wastewater infrastructure and nutrient management in land use plans if they are truly critical issues. Fewer than 50% of campers included or mentioned wastewater treatment systems or nutrients in land use plans. Only 35% sited septic systems on suitable soils and only 22% mentioned nitrogen or phosphorus in their presentations. Taking into account the finding of Jordan et al. (1986), this program reinforces the idea that issues awareness instruction is not enough.

More activities involving water and wastewater systems and visits to working and failing systems must be incorporated into the water quality lessons and escorted walk across the property at Conservation Camp. Exercises or games on balancing animal numbers with the land available for manure application, soil testing and determining nutrient needs of crops can also be included. Follow-up studies with conservation campers also need to be done to measure retention and use of the knowledge and skills gained at the camp. With large numbers of campers that have attended Conservation Camp through its 60 year history, comparisons of career choices, involvement in land-use planning, and lifestyle decisions can be made to a similar group of teenagers. Through longitudinal study, trends in conservation planning and approaches may become evident in young people who choose to participate in conservation programs such as 4-H Conservation Camp.

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